

PATTERNED CONDUCTOR TOUCH SCREEN HAVING IMPROVED OPTICS

[0001] This invention relates to touch screens, and particularly to on-display touch screens that utilize a pattern of transparent conductors as the touch sensing elements.

BACKGROUND

[0002] Touch screens have become an increasingly common way for users to intuitively interact with electronic systems, typically those that include displays for viewing information. Touch screens include transparent touch screens that can be disposed over variable displays and/or static images so that the displayed information and images can be viewed through the touch screen. Touch screen technologies that can be used in such configurations include resistive, capacitive, projected capacitive, and surface acoustic wave, among others. Many projected capacitive touch screens utilize a pattern of conductors as the sensing elements. The term "projected capacitive" refers to the ability of the pattern of conductors to project a field through a relatively thick dielectric such as a thin glass panel, the glove of a gloved finger, and so forth. Because projected capacitive touch screens can sense through thicker materials, such touch screens can be ruggedized and made vandal resistant, and therefore can be well suited to public access applications and extreme environments.

SUMMARY OF THE INVENTION

[0003] In one aspect, the present invention provides a construction for a touch screen that includes a substrate, a coating substantially covering the substrate, a transparent conductor pattern disposed on the coating, the pattern leaving areas of the coating uncovered, and a filler material covering and contacting both the transparent conductor pattern and the areas of the coating not covered by the transparent conductor pattern. The coating has a refractive index that is less than the refractive index of the substrate and less than the refractive index of the transparent conductor pattern. A second substrate can optionally be disposed over the filler material.

[0004] The present invention also provides a touch screen construction that includes a transparent conductor patterned on a substrate, a first layer substantially covering the substrate and disposed between the transparent conductor and the substrate, the first layer configured to increase visible light transmission through the touch screen construction in areas covered by the transparent conductor, and a second layer disposed to contact the transparent conductor in areas covered by the transparent conductor and to contact the first layer in areas not covered by the transparent conductor, the second layer configured to substantially inhibit visible light reflections at contact interfaces between the first layer and the second layer.

[0005] The present invention also provides a method for reducing the visibility of a patterned transparent conductor in a touch screen. The method includes coating an undercoat material between a substrate and a patterned transparent conductor so that the undercoat material substantially covers the substrate, the undercoat material having a refractive index that is less than that of the substrate and that of the patterned transparent conductor. The patterned transparent conductor leaves areas of the undercoat material exposed.

The method also includes disposing a filler material over the patterned transparent conductor and exposed areas of the undercoat material, the filler material having a refractive index and thickness selected to reduce interfacial reflections of visible light in areas covered by the patterned transparent conductor.

[0006] The above summary of the present invention is not intended to describe each disclosed embodiment or every implementation of the present invention. The Figures and the detailed description that follow more particularly exemplify these embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The invention may be more completely understood in consideration of the following detailed description of various embodiments of the invention in connection with the accompanying drawings, in which:

[0008] FIG. 1 is a schematic side view of a touch screen construction of the present invention;

[0009] FIG. 2 is a schematic side view of a touch screen construction of the present invention;

[0010] FIG. 3 is a schematic plan view of a touch screen construction utilizing a pattern of transparent conductors as sensing elements;

[0011] FIG. 4 is a schematic side view of a touch screen construction of the present invention;

[0012] FIG. 5 is a schematic side view of a touch screen construction of the present invention;

[0013] FIG. 6 is a schematic side view of a touch screen construction of the present invention; and

[0014] FIG. 7 is a schematic side view of a touch screen system.

[0015] While the invention is amenable to various modifications and alternative forms, specifics thereof have been shown by way of example in the drawings and will be described in detail. It should be understood, however, that the intention is not to limit the invention to the particular embodiments described. On the contrary, the intention is to cover all modifications, equivalents, and alternatives falling within the spirit and scope of the invention.

DETAILED DESCRIPTION

[0016] The present invention is related to touch screens, particularly to touch screens that utilize a pattern of transparent conductors as sensing elements, and even more particularly to such touch screens that are transmissive of visible light so that an image can be viewed through the touch screen, for example on-display touch screens. Many touch screens utilize transparent conductors as sensing elements, and these elements can be provided as a continuous coating or in a pattern such as discontinuous stripes, lines, pads, or the like. Transparent conductors generally have optical properties that can lead to reflections (for example due to an index of refraction difference between the transparent conductor and the underlying substrate), lower transmission (for example due to absorption and reflection of light), and coloration (for example due to preferential absorption over a particular range of wavelengths in the visible spectrum). When the transparent conductor is pro-